

Therefore, it is possible to compare the temperature detected by the flow amount detector 21 and a temperature different from the reference temperature but determined to variably change with the reference temperature based on the distance between the flow amount detector 21 and the heater 30.

IN THE CLAIMS

Ab Please substitute the following amended claim 11 for corresponding claim 11 previously presented. A copy of the amended claims showing current revisions is attached.

11. (Amended) A flow amount measuring apparatus comprising:
a substrate;
a heater formed on the substrate and controllable to a first reference temperature;
a first temperature detector formed on the substrate at a position upstream of the heater;
a second temperature detector formed on the substrate at a position close to the heater, said second temperature detector being disposed at one of the upstream and downstream sides of the heater;
a control circuit connected to the heater, the first temperature detector and the second temperature detector and including a heater control part and a flow amount measuring part, the first temperature detector being for detecting a first temperature and connected to at least one of the heater control part and the flow amount measuring part,

*Ab
cond.*
the second temperature detector being connected to the flow amount measuring part, and
the flow amount measuring part producing an output varying with a difference between a
second temperature detected by the second temperature detector and a second reference
temperature and with a flow direction of fluid passing along the substrate.

\ Add new claims 17-48:

--17. (New) A flow amount measuring apparatus as in claim 1 wherein:
said heater has a total width larger than that of the fluid temperature detector and
the fluid amount detector in a fluid flow direction, and

A1
said flow amount detector is disposed in closer proximity to the heater than is the
fluid temperature detector with respect to fluid flow direction.

18. (New) A flow amount measuring apparatus as in claim 11 wherein:
said heater has a total width larger than that of the fluid temperature detector and
the fluid amount detector in a fluid flow direction, and
said flow amount detector is disposed in closer proximity to the heater than is the
fluid temperature detector with respect to fluid flow direction.

19. (New) A fluid flow amount and direction measuring apparatus comprising:
a flowing fluid temperature detector disposed in a fluid flow passage;
a controllable heater also disposed in said fluid flow passage;

a fluid flow detector disposed upstream or downstream of said controllable heater and providing a temperature dependent resistance that is a predetermined function of both fluid flow amount and fluid flow direction.

20. (New) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

A7
cont. means for producing an output signal corresponding to the difference between the temperature of said fluid flow detector and a fixed temperature.

21. (New) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

means for producing an output signal corresponding to the difference between the temperature of said fluid flow detector and the detected flowing fluid temperature.

22. (New) A fluid flow amount and direction measuring apparatus as in claim 19 wherein the fluid flow detector is disposed upstream of the heater with respect to a forward direction of fluid flow and further comprising:

output means is for producing an output signal varying in a dependence on fluid flow in a forward direction and in a reverse direction when the temperature detected by the fluid flow detector is lower and higher than a predetermined temperature, respectively, and varying in dependence on temperature difference between the predetermined temperature and a temperature detected by the fluid flow detector.

23. (New) A fluid flow amount and direction measuring apparatus as in claim 19 wherein the fluid flow detector is disposed downstream of the heater with respect to a forward direction of fluid flow; and further comprising:

output means for producing an output signal varying in dependence on fluid flow in a reverse direction and in a forward direction when the temperature detected by the fluid flow detector is lower and higher than a predetermined temperature, respectively, and varying in dependence on a temperature difference between the predetermined temperature and a temperature detected by the fluid flow detector.

24. (New) A fluid flow amount and direction measuring apparatus as in claim 19 wherein:

the heater temperature at one upstream/downstream side and the other downstream/upstream side is lower/higher than the reference temperature, respectively.

25. (New) A fluid flow amount and direction measuring apparatus as in claim 19 wherein:

the flow detector is disposed to detect a temperature which is (a) lower and (b) higher than the reference temperature when the fluid flow is (a) in a direction from the flow amount detector to the heater and (b) in a direction from the heater to the flow amount detector, respectively.

26. (New) A fluid flow amount and direction measuring apparatus as in claim 19 wherein:

the heater includes a strip which turns at a plurality of points to have a total width larger than that of the fluid temperature detector and the fluid flow detector in a fluid flow direction.

27. (New) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

a substrate on which the fluid temperature detector, the fluid flow detector and the heater are formed, the substrate having a cavity underneath the fluid temperature detector.

28. (New) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

a substrate on which the fluid temperature detector, the fluid flow detector and the heater are formed, the substrate having slits at the upstream side of the flow detector and the downstream side of the heater.

29. (New) A fluid flow amount and direction measuring apparatus comprising:

a substrate;

a controllable heater formed on the substrate;

a first temperature detector formed on the substrate at a position upstream of the heater;

a second temperature detector formed on the substrate at a position closer to the

heater than the first temperature detector, said second temperature detector being disposed at one of the upstream and downstream sides of the heater; and

a control circuit connected to the heater, the first temperature detector and the second temperature detector and including a heater control part and a flow amount measuring part,

the first temperature detector being controlled to detect a first temperature and connected to at least one of the heater control part and the flow amount measuring part,

the second temperature detector being connected to the flow amount measuring part, and

*A7
cont.*

the flow amount measuring part producing an output signal varying as a function of (a) the difference between a temperature detected by the second temperature detector and a reference temperature and (b) the flow direction of fluid passing along the substrate.

30. (New) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the first temperature detector is connected to the heater control part so that the heater is controlled to vary its temperature with the temperature detected by the first temperature sensor; and

the reference temperature is fixed.

31. (New) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the first temperature detector is connected to the second temperature detector so that the temperature detected by the second temperature detector is corrected by the temperature detected by the first temperature detector.

32. (New) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the heater has a width in a direction of fluid flow which is larger than that of the second temperature detector.

33. (New) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the substrate has cavities at locations and underneath the first temperature detector, the heater and the second temperature detector.

34. (New) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the substrate has a slit formed between the second temperature detector and the heater.

35. (New) A fluid flow amount and direction measuring method comprising:
detecting flowing fluid temperature in a fluid flow passage;
controlling the temperature of a heater also disposed in said fluid flow passage;

detecting fluid flow at a location upstream or downstream of said controllable heater and providing a temperature dependent resistance that is a predetermined function of both fluid flow amount and fluid flow direction.

36. (New) A fluid flow amount and direction measuring method as in claim 35 further comprising:

producing an output signal corresponding to the difference between the detected temperature of said fluid flow and a fixed temperature.

37. (New) A fluid flow amount and direction measuring method as in claim 35 further comprising:

producing an output signal corresponding to the difference between the temperature at the location of detecting fluid flow and the detected flowing fluid temperature.

38. (New) A fluid flow amount and direction measuring method as in claim 35 wherein the fluid flow detection location is disposed upstream of the heater with respect to a forward direction of fluid flow and further comprising:

producing an output signal varying in dependence on fluid flow in a forward direction and in a reverse direction when the temperature at the location of fluid flow detection is lower and higher than a predetermined temperature, respectively, and varying in dependence on temperature difference between the predetermined temperature and a temperature detected at the location of the fluid flow detection.

39. (New) A fluid flow amount and direction measuring method as in claim 35 wherein the fluid flow detection location is disposed downstream of the heater with respect to a forward direction of fluid flow and further comprising:

producing an output signal varying in dependence on fluid flow in a reverse direction and in a forward direction when the temperature at the location of fluid flow detection is lower and higher than a predetermined temperature, respectively, and varying in dependence on temperature difference between the predetermined temperature and a temperature detected at the location of the fluid flow detection.

At
cont.

40. (New) A fluid flow amount and direction measuring method as in claim 35 wherein:

the heater temperature at one upstream/downstream side and the other downstream/upstream side is lower/higher than the reference temperature, respectively.

41. (New) A fluid flow amount and direction measuring method as in claim 35 wherein:

the flow detection location is disposed to detect a temperature which is (a) lower and (b) higher than the reference temperature when the fluid flow is (a) in a direction from the location of flow amount detection to the heater and (b) in a direction from the heater to the location of flow amount detection, respectively.

42. (New) A fluid flow amount and direction measuring method as in claim 19 further comprising:

using a fluid temperature detector, fluid flow detector and heater formed on a substrate having a cavity underneath the fluid temperature detector.

43. (New) A fluid flow amount and direction measuring method as in claim 35 further comprising:

using a fluid temperature detector, fluid flow detector and heater formed on a substrate having slits at the upstream side of the flow detector and the downstream side of the heater.

*by
cont.*

44. (New) A fluid flow amount and direction measuring method comprising:
forming a controllable heater on a substrate,
forming a first temperature detector on the substrate at a position upstream of the heater;

forming a second temperature detector on the substrate at a position closer to the heater than the temperature detector, said second temperature detector being disposed at one of the upstream and downstream sides of the heater; and

controlling the first temperature detector to detect a first temperature;
connecting the second temperature detector to a flow amount measuring circuit, and producing an output signal varying as a function of (a) the difference between a temperature detected by the second temperature detector and a reference temperature and (b) the flow direction of fluid passing along the substrate.

KOHNO

Serial No. 09/421,086

45. (New) A fluid flow amount and direction measuring method as in claim 44 wherein:

the heater is controlled to vary its temperature with the temperature detected by the first temperature sensor; and

the reference temperature is fixed.

46. (New) A fluid flow amount and direction measuring method as in claim 44 wherein:

the temperature detected by the second temperature detector is corrected by the temperature detected by the first temperature detector.

47. (New) A fluid flow amount and direction measuring method as in claim 44 wherein:

the substrate has cavities at locations underneath the first temperature detector, the heater and the second temperature detector.

48. (New) A fluid flow amount and direction measuring method as in claim 44 wherein:

the substrate has a slit formed between the second temperature detector and the heater.--